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Enumeration of the Peronosporeæ of the United States.*

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In 1876 I published in the Bulletin of the Bussey Institution an account of the species of *Peronospora* and *Cystopus*, known at the time to occur in the United States, and the total number given was only ten. Having occasion recently to review the species of those genera in my collection, it occurred to me that, considering how many species have been added to our flora since 1876, it would be desirable to prepare a new list which should be as complete as the materials in my possession would permit, and, as the descriptions of some of the species are not accessible to many persons in this country who desire to study the subject, to add descriptions of all our species. The material examined has been specimens which I have collected myself and specimens in my herbarium, for which I am indebted to the kindness of several correspondents. In the arrangement of the synonymy I have endeavored to give the synonyms which are likely to be most frequently seen in text-books and agricultural treatises, and those who care for a detailed account of the synonymy of the more common species are referred to DeBary's original paper. Frequent references are made to American botanical works where our native species are mentioned; and where American specimens have been distributed in published exsiccati I have given the numbers, when they are known to me, without going so far as to quote European specimens of species which occur also in this country. The additions to our *Peronosporeæ* are mainly scattered through the reports of the New York State Botanist, Mr. C. H. Peck, and in the Bulletin of the Bussey Institution, and Ellis's North American Fungi Century III. contains a num-

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ber of dried specimens of our species. I have incorporated in the list the species mentioned by Harkness and Moore in their catalogue of the Pacific Coast Fungi,[1] although, with a few exceptions, I have not examined specimens myself, but have given them on the authority of Dr. Harkness.

Our exact knowledge of the development and systematic position of the *Peronosporeæ* dates from DeBary's classic monograph, *Recherches sur le développement de quelques champignons parasites*,[2] published in 1863, in which were described the greater part of our species. In a subsequent memoir, *Untersuchungen Ueber die Peronosporeen und Saprolegnieen*,[3] published in 1881, DeBary gives his views on the nature of the reproduction in *Peronosporeæ*, and their relation to allied orders of fungi, so that, except perhaps with regard to the germination of the oospores, there remains almost nothing to be studied in connection with the history of the development of this group of fungi.

In his last paper DeBary includes in the *Peronosporeæ* four genera: *Pythium*, *Phytophthora*, *Peronospora*, and *Cystopus*. In this country the species of *Pythium* have not been sufficiently studied, and no mention is made of them in this paper, although they possess a decided agricultural interest, since one species apparently causes what is known in some parts of the Eastern States as the potting bed fungus, which is very destructive to young house plants in the winter. Other species are known in decaying plants in damp ground. The species of the three remaining genera attack living plants, especially herbaceous exogens, and produce their oospores or resting spores in the interior of the leaves and young stems and bear their conidial spores on the surface. The oospores of all three genera are similar and produced in the same way, which can be learned from any of the recent text books of botany. They are globose and borne singly in an oogonium. They have two coats, the inner (Endospore) of which is first formed, while the outer (Exospore or Epispore) is formed, if one can say so, by a condensation of the surrounding protoplasm upon the endospore. In this way there is formed on the outer part of the oospore a covering which is either nearly smooth or marked with folds, ridges, or reticulations.

The three genera can not be distinguished from one another by their oospores, but the conidial spores serve to mark the

[1] Cal. Acad. Science, Feb. 2, 1880.
[2] Annales des Sciences Naturelles, 4 Série. T. 20.
[3] Beiträge zur Morphologie und Physiologie der Pilze. DeBary & Woronin. 4 Reihe.

genera in question. In *Phytophthora* and *Peronospora* the mycelium in the interior of the leaves makes its way to the surface, in most cases passing through the breathing pores. That part of the mycelium which passes into the air and bears the conidia is called the conidiophore. In *Phytophthora* it is a simple or branching filament, at whose tip or tips is formed an ovate cell, the conidium. Before the conidium falls from its attachment the conidiophore, at its base, swells on one side and then grows upward, pushing the conidium to one side so that it appears to have been formed by a lateral outgrowth. The elongated conidiophore then bears a new conidium at its tip, which is in turn pushed to one side by the growth of the conidiophore, as before. The genus *Phytophthora* may then be recognized either by having one or more conidia borne laterally on the conidiophore, or, as is more frequently the case, by the swellings at intervals in the upper part of the conidiophore, indicating where conidia have fallen off.

In the genus *Peronospora* the conidiophore is a branching or rarely a simple filament which bears the conidia singly at the tips which do not afterwards elongate, as in *Phytophthora*. In a few species where the conidiophore is rather robust, instead of bearing a single conidium, the tip bears a number of short processes, or teeth, on each one of which is borne a conidium, as in *P. entospora* and *P. gangliformis*.

In *Cystopus* the mycelium, instead of passing through the stomata into the air, collects in spots under the epidermis, which is then ruptured and turned back, and the filaments which correspond to the conidiophores in the other genera are very short and stout, and densely packed together and grow into simple chains of conidia by transvere cell division. Hence, while *Phytophthoræ* and *Peronosporæ* appear to the naked eye like fine frost like patches, especially on the under surface of the leaves, species of *Cystopus* produce dead white spots not limited to the under surface of the leaves.

The species of *Phytophthora* and *Cystopus* are few in number and it is not necessary to subdivide these genera, but as there is a considerable number of species of *Peronospora* it is usual to subdivide the genus. The subdivisions made by DeBary depend upon the mode of germination of the conidia; in the first division he places the species whose conidia give off a number of zoospores in germination; in the second, including only two species, the whole contents of the conidia are discharged in a mass which is not however motile, but which at once pushes

forth a new filament; in the third the conidia send out filaments directly from the apex; and in the fourth they produce filaments from any part of the surface but especially laterally. These subdivisions are based on physiological rather than morphological grounds, it will be seen, but it may be added that there is a more or less closely corresponding morphological difference. In the first subdivision with zoospores the ramification of the conidiophores is pinnate, if we except the anomalous *P. entospora*, which does not branch at all, and the minute *P. pusilla*, which can hardly be said to branch. The second division includes only two small species in which the ramification is not well marked. The third and fourth divisions run into one another, since the species of the latter sometimes germinate at the tip. As it is, the third division includes only one but a very distinct species where the ramification is dichotomous, but the tips are swollen and bear a number of radiating sterigmata. The species of the fourth and largest division are dichotomous and in several cases so much alike that they can hardly be distinguished by the conidiophores alone. The haustoria of the different sections are, to a certain extent, characteristic. In the first section they are of the spheroidal type, while in the last two sections they are generally filiform or club shaped, and frequently branch. A species of *Peronospora* can be said to be satisfactorily known only when both conidia and oospores have been observed and the germination of the conidia ascertained. The germination of the oospores has been seen only in a very small number of species, and this element can not be used in the systematic classification of the genus.

In spite of the small number of known species of *Cystopus*, our species, it must be confessed, are as yet unsatisfactorily known. This arises principally from the fact that the conidia alone are not sufficiently characteristic, and on several hosts oospores have not yet been found. In some of the species the conidia are all alike in shape, and in germinating they give off zoospores. In others the terminal conidia of the chains differ in shape from the rest, and are said, on the authority of Tulasne, to germinate by means of an outgrowing tube instead of by zoospores. The conidia of species of *Cystopus* are of two types, the spherical and the cylindrical, or cuboidal as they are sometimes incorrectly termed, but, without a knowledge of the oospores as well, it is evident that one can not safely unite forms on widely different hosts, guided only by the ill-marked distinctions afforded by the conidia.

PHYTOPHTHORA DeBary.

Conidia at first solitary and terminal, but becoming lateral by the outgrowth of the tip of the conidiophore. Several conidia produced in succession. Germination by zoospores.

PH. INFESTANS (Mont.) DeBary. *Potato Rot.*

Botrytis infestans Mont., *Bot. devastatrix* Lib., *Peronospora devastatrix* Casp., *Peronospora infestans* Casp., DeBary et al.

Exs. Mycotheca Universalis no. 926.

Mycelium slender, without haustoria. Conidiophores simple or with a few irregularly placed branches, attenuated at the apex, with one or more nodosities below at the insertion of the conidia. Conidia ellipsoid or oval with a terminal papilla. Oospores?[1]

Common on cultivated potatoes from Maine to California (Harkness), and on tomatoes to South Carolina (Ravenel). Europe.

PERONOSPORA Corda.

Conidiophores variously branched or rarely simple, conidia always terminal. Germination either by zoospores or outgrowing tubes.

Section I. ZOOSPORIPARÆ. Conidiophores pinnately branching, ultimate divisions often glomerate. Germination by zoospores.

1. P. VITICOLA (Berk. & Curt.) DeBary.

Botrytis cana Schw. in Herb. Schweinitz non *B. cana* Lk.
Botr. viticola Berk. Crypt. Bot. 301; 23d Rept. N. Y. Bot. 61.
Per. viticola DeBary Ann. Sci. Nat. 4 Ser. T. XX. 121; Bull. Bussey Inst. I. 427; Grevillea III. 109, VI. 139. Bull. Ill. Mus. I. p. 55, pl. II. 687.
Exs. Mycotheca Universalis 617; Ellis North Am. Fung. 208; Ravenel Fung. Car. V. 60; Fung. Amer. 61.

Mycelium varicose, haustoria small, spherical. Conidiophores with a long, slender main axis, with a few short, subequal, alternate, horizontal 1 to 3 pinnate branches at the top. Tips acute, densely clustered in sets of usually three. Conidia small, ovoid-obtuse, average 17–23μ by 13–17μ. Oospores about 30–38μ, rather thin walled, yellowish, exospore smooth or slightly wrinkled.

Common on wild and cultivated grapes east of the Rocky Mts. Europe. Algiers. Appearing with us in midsummer and autumn.

NOTE.—Since the introduction of our grape mould into Europe an immense amount has been written on its progress and prevention. In this connection the reader is referred to the latest work on the subject: *Le Peronospora des Vignes*, by Dr. Max. Cornu, 1882, in which the bibliography is very fully given with admirable plates of the fungus.

[1]The oospores of this species are unknown to DeBary. Mr. Worthington G. Smith, in Gardener's Chronicle, July 17, 1875, and Quart. Journ. Micros. Sci., October, 1875, reported the discovery of oospores, and in the last named journal gave photographic copies of his preparation. The discussion which took place on this subject has frequently been quoted in American journals, and those who wish to examine the question more fully should consult DeBary's *Researches into the nature of the Potato Fungus*, Jour. Royal Agric. Soc. of England, and the two papers of Mr. Smith previously mentioned.

2. P. HALSTEDII Farlow.

Proc. Am. Acad. XVIII. 72.
Exs. Ellis N. Am. Fung. 209, 210.

Mycelium with oval haustoria. Conidiophores rather stout, undivided below, above with numerous 1 to 4 pinnate horizontal branches, the lower of which are considerably longer and more compound than the upper. Tips long, slender, acute, loosely diverging. Conidia oval or elliptic, 19–30μ by 15–26μ. Oospores 23–30μ in diameter, yellowish, thin walled, exospore with a few folds or ridges.

On *Ambrosia artemisiæfolia, Eupatorium purpureum, Bidens frondosa, Rudbeckia laciniata, Silphium terebinthinaceum, Helianthus strumosus, H. doronicoides, H. tuberosus,* and *Solidago Canadensis.* Oospores on *H. doronicoides.*

From Mass. (Farlow) to Illinois (Burrill, Seymour), Iowa (Bessey, Arthur), Wisconsin (Trelease), and south to New Jersey (Ellis).

A widely diffused and apparently common species in the Northern States, but not yet reported from the Southern States. It may be expected to occur on almost any of the *Tubulifloræ* in midsummer and autumn. It can be distinguished from *P. viticola* by the more pyramidal outline of the conidiophores, the lower branches of which are usually decidedly longer than the upper, while in the ordinary forms of *P. viticola* the branches are all short, and by the longer less compact tips. The present species varies considerably, the form on *Helianthus* being very much branched and forming prominent woolly patches on the leaves, while in the form on *Ambrosia* the spots are minute and the branching less compound.

3. P. OBDUCENS Schroeter.

Hedwigia XVI. p. 129. Sept. 1877; Bull. Buss. Inst. II. 234; Proc. Am. Acad. XVIII. 70.
Exs. Ellis N. Am. Fung. 207.

Mycelium varicose, haustoria rather large, spheroidal. Conidiophores long and slender, branches slender, flexuous, loosely 2 to 3 pinnate, diverging in all directions, inserted rather acutely. Tips slender, acute. Conidia small, oval or ellipsoidal, 15–20μ by 12–15μ. Oospores 30–40μ in diameter, exospore yellowish, nearly smooth.

On *Impatiens fulva.*

Mass. (Farlow) to Illinois (Seymour) and Iowa (Bessey). Europe.

The species appears in the spring on the cotyledons, whose under side is densely covered by the conidia. Later in the season it forms small scattered spots on the leaves. The species is distinguished from the preceding by having the branches regularly arranged so that they diverge in all directions, while in the preceding they are very irregular, or with a tendency to a distichous arrangement. In this species the branches are not usually inserted at right angles, as in the preceding, but somewhat acutely. The tips are sharp and straight, but not so closely consolidated at the base as in related species.

4. P. GERANII Peck.

28th Report N. Y. Bot. p. 63.
P. nivea Ung. var. *Geranii* Farlow Bull. Buss. Inst. I. 426; Proc. Am. Acad. XVIII. 73.
Exs. Ellis N. Am. Fung. 218.

Mycelium large, with oval haustoria. Conidiophores short and delicate, axis naked below, bearing at the tip a few short horizontal 1 to 2 pinnate branches. Tips long, slender, divergent. Conidia broadly ellipsoidal, 17–23μ by 15–18μ. Oospores 30–40μ in diameter, exospore yellowish-brown, somewhat rugose.

On *Geranium maculatum* (oospores), *G. Robertianum* and *G. Carolinianum*.

Mass. (Farlow), New York (Peck), Michigan (Spalding), to Wisconsin (Trelease).

Found throughout the summer, forming large patches between the principal veins, sometimes almost covering the whole under surface of the leaves and causing yellow discolorations of the upper surface. Hardly to be distinguished from *P. nivea*. Differing from the preceding members of the section in its shorter main axis, its short and at times very condensed branches with longer spreading tips.

I have received from Mr. F. S. Earle specimens collected on *G. Carolinianum*, at Cobden, Ill., which were very puzzling. The conidiophores were very irregularly branched and scanty, and there were two kinds of conidia, some of the size given above, and others very much larger, in fact, enormous. On examination the large conidia were found to be borne, not on the conidiophores proper, but in the following manner: The mycelium in the leaf made its way to the stoma, but instead of growing upwards and branching it at once expanded into one or two enormous conidia which appeared to be resting on a stoma. A similar condition has been described by Cornu in *P. viticola*, but his figure is not so striking as the specimens from Illinois. The latter were collected in April, and a similar condition also exists in *P. Violæ*, collected by Mr. Earle, also in April. It may be that this suppression of the ordinary conidiophore and the substitution of large sessile conidia is a common occurrence early in the season. In spite of their abnormal appearance I presume that the specimens on *G. Carolinianum* from Illinois probably are to be included under *P. Geranii*, but the scanty conidiophores did not present a typical appearance, but resembled somewhat those of *P. pusilla* Ung. Examination of a larger set of specimens is necessary to settle this form.

5. P. NIVEA (Ung.) DeBary.

Botrytis nivea Unger Exanthem. 171.
Per. nivea Ung. Bot. Zeit. 1847, in part; DeBary l. c. 101. Pl. IV: Cat. Pacif. Fung. 29.
Per. Umbelliferarum Casp. Berlin Acad. Monatsber.

Haustoria obovate. Conidiophores short, bearing near the apex a few short horizontal 1 to 2 (rarely 3) pinnate branches. Tips subulate, straight, rarely subflexuous. Conidia subglobose, slightly papillate. Oospores large, with a pale yellowish-brown, smooth, or subrugose exospore.

On *Umbelliferæ*. California (Harkness). Europe.

This common form on *Umbelliferæ* in Europe is unknown to me in the United States, except from the catalogue of Harkness and Moore, on whose authority the species is inserted, the description being founded on European material.

Section II. BASIDIOPHORA. Conidiophores simple, surmounted by a number of sterigmata. Germination by zoospores.

6. P. ENTOSPORA (Cornu & Roze) B. & Br.

Basidiophora entospora Cornu & Roze Ann. Sci. Nat. 5me Série T. XI. p. 89. Pl. IV. f. 1–12.
P. entospora B. & Br. Grevillea, I. 20; Proc. Am. Acad. XVIII. 73.
P. Basidiophora Cornu Bull. Soc. Bot. France, XXV. 294.
P. simplex Peck, 31st Rept. N. Y. Bot. p. 45.

Conidiophores simple, stout, clavately swollen at the tip with numerous sterigmata on which are borne the very large, 26–32 η long, broadly ovate, papillate conidia. Oospores large, 34–41 μ in diameter, exospore marked with ridges.

On *Aster Novæ Angliæ*, *Erigeron Canadense* and *Solidago rigida*. Oospores on *Aster* and *Erigeron*.

New York (Peck) to Illinois (Burrill) and Wisconsin (Trelease). France, England, Germany.

Probably common in the United States, but first found in France, where it was probably introduced from America. It occurs from May to October, producing rather insignificant discolorations of the leaves. It has not yet been observed in New England. One of the most peculiar species of the genus, characterized by its simple conidiphores and very large conidia borne on sterigmata and perhaps rather to be regarded as a generic type.

Section III. PLASMATORARÆ. Conidia white, in germination the whole contents being discharged and forming a free globose cell from which grows a tube.

7. P. PYGMÆA Unger.

De Bary l. c. Pl. VII. f. 10–15; Bull. Buss. Inst. II. 233; 29th Rept. N. Y. Bot. p. 5; 30th Rept. p. 77; Cat. Pacif. Fung. p. 29.
Exs. Myc. Univ. 924; Ellis N. Am. Fung. 211.

Mycelium large, haustoria small, obovate. Conidiophores short, stout, unbranched except close to the apex where there are a few rudimentary branches. Conidia ovate, 20–26 μ by 15–19 μ, papillate. Oospores large, dark brown, thick-walled, 45–53 μ in diameter, exospore slightly rugose.

On *Anemone nemorosa*, *A. Pennsylvanica*, and *Hepatica triloba*.

Mass. (Farlow), New York (Peck), Illinois (Seymour), to California (Harkness). Europe.

A common species on *A. nemorosa* in the Eastern States during the spring and early summer, often accompanying other fungi. I have been able to examine specimens on *A. nemorosa* only where the conidiophores are stout and scarcely branched at all. What is called by De Bary var. *elongata* I have not seen in this country.

Section IV. ACROBLASTÆ. Conidia white, germinating by a terminal tube. Ramification dichotomous.

8. P. GANGLIFORMIS (Berk.) De Bary.

Botrytis ganglioniformis Berk. Lond. Jour. Hort. Soc. I. 51. Pl. 4.
P. ganglioniformis Tul. Compt. Rend. XXXVIII. 26.
P. gangliformis De Bary l. c. Pl. VIII. f. 1–3; Bull. Buss. Inst. I. 427; Cat. Pacif. Fung. p. 29. Bull. Ill. Mus. I. p. 551, pl. II. 3.
Exs. Ellis N. Am. Fung. 219

Mycelium with ovate haustoria. Conidiophores simple below, slender, becoming several times dichotomous, the divisions often recurved, swelling at the tip into clavate or cup-shaped bodies from which radiate several sterigmata. Conidia small, globose or ellipsoidal, 16–23 μ by 16–20 μ. Oospores yellowish, thin walled, 26–34 μ in diameter. Exospore smooth.

On *Nabalus albus* (oospores), *Lactuca altissima*, *L. Canadensis*, *L. sativa*, and *Mulgedium leucophæum*.

New Hampshire, Mass., New York (Farlow), Iowa (Bessey), Illinois (Burrill), to Wisconsin (Trelease). Europe.

A species easily recognized by the swollen or cup-shaped tips from which radiate a few sterigmata. It does considerable harm near Boston and New York to early lettuce raised in hot-beds. I have seen oospores on *Nabalus albus* only. The species is apparently common with us and will be found on several other hosts than those mentioned above. It has not yet been seen in this country on *Senecio vulgaris* on which it produces oospores in Europe.

Section V. PLEUROBLASTÆ. Conidia white or violet colored. Germination by tubes given off from any part of the conidia, but especially the sides. Ramification dichotomous.

A. *Parasiticæ*. Wall of oogonium thick and rigid. Oospores with a thin, smooth exospore.

9. P. PARASITICA (P.) Tul.

Botrytis parasitica Persoon Observ. I. 96.
P. parasitica Tul. Compt. Rend.; De Bary l. c. p. 106, Pl. IX. f. 5–8; Bull. Buss. Inst. I. 428; 26th Rept. N. Y. Bot. p. 79; Cat. Pacif. Fung. p. 29.
P. Dentariæ Rabh. Fung. Eur. 86.
Exs. Ellis, N. Am. Fung. 212.

Mycelium large, with very large clavate or branching root-like haustoria. Conidiophores stout and simple below, branching above, rather abruptly and irregularly dichotomous, the divisions dense, slender and flexuous. Tips subulate, curved. Conidia white, broadly ellipsoidal. Oospores 26–43 μ in diameter. Exospore brown and nearly smooth.

In *Capsella Bursa-pastoris*, *Lepidium Virginicum*, *Brassica sativa*, *Rhaphanus sativus*, *Cardamine rhomboidea*, and *Dentaria laciniata*. Oospores on *Cardamine* and *Dentaria*.

Mass. (Farlow), New York (Peck), to Delaware (Farlow), North Carolina (Curtis) and west to Wisconsin (Trelease), Kentucky (Kellerman) and California (Harkness). Europe.

A common species on *Cruciferæ* in all parts of the country, often in company with *Cystopus candidus*, on which it was once believed to be parasitic. It occasionally causes considerable damage to the cabbage crop. On *Lepidium* and *Capsella* it covers the under surface of the leaves with a dense fleece, but on

cabbages and *Cardamine* it is less dense. The oospores are not very frequent, considering how common the species is. Although subject to considerable variation, the species is comparatively easily recognized by the stout conidiophores which are abruptly dichotomous above, the divisions being slender and densely ramified. The haustoria are especially large and easily studied. The form on *Dentaria* from Kentucky corresponds precisely with Rabenhorst's original specimens of *P. Dentariæ*.

10. P. POTENTILLÆ De Bary.

De Bary l. c. p. 120; Bull. Buss. Inst. 233; Cat. Pacif. Fung. 29.
Exs. Ellis N. Am. Fung. 217.

Conidiophores slender, several times dichotomous, divisions distinctly flexuous. Tips attenuate, approximate in pairs, curved. Conidia violet colored, ellipsoidal, 20–26 μ by 15–19 μ. Oospores yellow, thin-walled, smooth, 22–24 μ in diameter.

On *P. Norvegica*.

Mass. (Farlow), California (Harkness). Europe.

As far as I am aware the oospores af this species have never been described. I found them on *P. Norvegica* in October, 1877. The oogonium is very thick-walled and rigid, and is almost completely filled by the oospore, which is almost exactly spherical and has a thin, smooth wall. In fact, at first sight, one would mistake the oogonium and its contents for a single thick-walled oospore so completely does the oospore fill the oogonium in most cases. In consequence of the structure of the oogonium, the present species must be placed in the same section as *P. parasitica* if we follow De Bary's classification. The species is common in Massachusetts from June to October. I have no specimens from the Western States, although I have heard that the fungus grows in that region.

In July, 1882, I found a *Peronospora* on *Geum album* at Wood's Holl, Mass., but it was not fully developed, and no oospores were seen. It formed ill-defined spots on the under side of the leaves, which showed a yellowish discoloration on the upper side. I presume that the form on *Geum* must be included in *P. Potentillæ*, although the conidiophores were more slender and less branched. At any rate, without more material, I should not venture to separate it as a distinct species.

11. P. CLAYTONIÆ n. sp.

Conidiophores long, naked below, several times dichotomous above, divisions short, flexuous. Tips short, subulate, widely spreading. Conidia broadly obovate, violet-colored, 22–24μ by 15–20μ. Oospores large, 38–45μ in diameter, brown, exospore more or less rugose.

On *Claytonia Virginica*.

Kentucky. Comm. J. B. Ellis.

The only specimens of this species which I have seen were those sent by Mr. Ellis. The leaves of the *Claytonia* were wrinkled and blackened, but no definite spots were found. The conidiophores were rather diffusely scattered, and the oogonia were large and did not contract around the spherical oospores,

which were brown, thin-walled and considerably smaller than the oogonia. The rigidity of the oogonium wall and other characters given above lead me to place the species in the present section, although it approaches the section *Effusæ*.

B. *Calothecæ*. Wall of oogonium thin, wrinkled at maturity. Exospore not smooth, but regularly tuberculose, verrucose, or reticulated. Haustoria filiform, branching.

12. P. MYOSOTIDIS DeBary.

DeBary l. c. p. 108. Pl. XIII, f. 5; Rabh. Fung. Eur. 572.

Conidiophores long, slender, several times dichotomous, ultimate divisions slender, widely spreading. Conidia ovate-obtuse 20–23μ by 15–18μ, faintly violet colored. Oospores rather small, 24–30μ in diameter, dark brown, exospore marked with regular reticulations.

On *Myosotis verna*.

Chebacco Lake, Mass. (Seymour), Cobden, Ill. (Earle). Europe.

Found on the leaves, especially the lower ones, in spring. Apparently not common. Recognized by the beautifully reticulated oospores which accompany the conidia in all the American specimens I have examined.

13. P. ARTHURI n. sp.

Conidiophores rather short and rigid, several times dichotomous. Tips rather short and rigid. Conidia broadly ellipsoidal, obtuse, 22–26μ by 19μ, slightly violet-colored. Oospores large, dark brown, 34–42μ in diameter, exospore covered with short blunt papillæ.

On *Œnothera biennis*.

Iowa (Arthur), Minnesota (Farlow).

This species, first detected by Prof. Arthur in Iowa, was found abundant on the shore of Lake Minnetonka, Minn. The fungus covers the under surface of the leaves in large patches, and the upper side of the leaves becomes pale yellow. The species is quite distinct from *P. Epilobii* Rabh., the conidiophores of which, as shown by Fung. Eur. no. 1747, are rather of the pinnate type, and whose conidia are not violet colored, but white. The papillate oospores also serve to distinguish the present from our other species. A form of *Peronospora* on *Œnothera* from New York is referred by Peck in his 30th Report to *P. effusa*.

14. P. VICIÆ (Berk.) DeBary.

This species, closely related to *P. Myosotidis*, and common in Europe on *Papilionaceæ*, is reported by Harkness and Moore to occur on pear leaves in California. It may, perhaps, be asked whether this is not a misprint for pea leaves. Certainly the species is not known elsewhere on pear leaves.

[TO BE CONTINUED.]

Notes on Edible Plants. I.

RANUNCULACEÆ

The natural order *Ranunculaceæ* includes in general plants of an acrid, caustic or poisonous nature, sometimes insipid, but often dangerous, and reference to their uses as poisons or in medicine are frequent. It has long been remarked, however, that the irritant principle has in general so little stability as to be expelled by heat, boiling or drying, and it may not exist in organs yet immature, hence various plants of this order have found use as aliments, as well as portions of the plant in which the dangerous substance does not appear to reside.

Among the species to which alimentary qualities have been ascribed are *Clematis flammula*, whose young shoots when boiled are said to be eaten (Maout & Decaisne); *Ranunculus auricomus* and *R. lanuginosus*, the leaves boiled and eaten (Duchesne); *R. bulbosus*, L., whose boiled leaves are edible (Lightfoot); *R. edulis*, Boiss., whose small tubers together with the young stems, leaves and blossoms, are brought to market in North Persia (Unger); *R. ficaria*, L., the pilewort, whose young leaves are boiled as a food by the Swedish peasantry (Linnæus); *R. repens*, L., the mildest of the genus, and said to be eaten as a pot-herb (Martyn); and *R. sceleratus*, L., which serves the shepherds of Wallachia as an edible after boiling (Don.), although Lindley says that beggars use its acrid leaves to produce ulcers and sores in order to excite compassion. *Caltha palustris*, in the Eastern United States, is a popular spring green, and under the name of cowslips is largely collected from the marshes about the villages of Massachusetts. Various species of *Nigella* produce pungent seeds, used as a condiment and a spice, as *N. arvensis*, L. (Don). *N. damascena*, L., is cultivated for its seeds in Turkey (Archer), and *N. sativa*, L., has been cultivated in Europe and the East, the seeds used for seasoning curries (A. Smith), as a pepper substitute in France (Guibort), and for spreading over bread and mixing with cakes by the Egyptians (A. Smith). *Aquilegia Canadensis*, L., var. *formosa*, Fisch., furnishes in its roots an aliment for the Indians of northwest America (R. Brown, Jr.), while *Pæonia albiflora*, Pal., furnishes food in its roots to the Tartars of Mongolia, who eat them after boiling, and also mix the powdered seeds with their tea (Pallas), and the same statement is made for *P. edulis* in Paradisus Londonensis.

—E. Lewis Sturtevant, M. D.

GENERAL NOTES.

Letter from Dr. Gray.—DEAR EDITOR: You will be glad to know and to announce to your readers that Dr. Englemann, who was, as the September *Gazette* says, "quite ill at Strasburg," has returned to us in good condition. When he came to us yesterday he showed no mark of illness nor lack of vigor.

Will you allow me to offer some remarks on your last issue? When a man has gone, he can not control the publication of his letters, nor can his friends, altogether. But I can imagine the distress with which the sensitive, modest and cautious Dr. Torrey would have read in print the youthful letter which your correspondent has sent you. I knew him intimately for forty years, and I can say that this letter of his is uncharacteristic. How young and inexperienced he then was may be seen from his statement that he and Mr. Knevels (which you have printed *Knerely*) had not time to write a flora with full description of the region thirty miles around New York that year, "so have put it off till next spring."

Do you think that botanists will approve your judgment, pronounced editorially and unqualifiedly, that "*it was very clearly shown that what must be considered as three distinct species of corn have been produced artificially?*" Is it really a scientific journal in which we read—not the announcement of discoveries made and laid before the world for judgment—but the announcement of discoveries which are going to be made? And in this wise:

"Really he is seeing incipient species springing up under his own manipulation, and can recognize the forces which are effecting the change. * * * Already has Dr. S. intimated certain results which will completely overturn and tear up by the roots some of our preconceived notions, and one of these days we may look for something startling." If I were in the place of the acute and zealous experimenter in question, I should deplore this kind of announcement, feeling that it would tend to create a prejudice against rather than in favor of the discoveries I had made, or was expecting to make.

Asking you to receive this volunteered counsel for whatever it may be worth, I remain truly your friend—A. GRAY.

Dr. Torrey's Letter.—The readers of the BOTANICAL GAZETTE are greatly indebted to Mr. Joseph F. James for the interesting undated letter from Dr. Torrey, which appeared in the last number. There is, however, evidence that the date assigned to it by Mr. James is too recent.

1. The "Lyceum of Natural History in the City of New York" spoken of in the letter, was incorporated April 20, 1818, but the society was formed in the latter part of February, 1817. A prefatory note prepared by Dr. Torrey for the Catalogue of Plants growing within thirty miles of New York, informs us that it was reported to the Lyceum Dec. 17, 1817, in pursuance of a resolution passed May 5, 1817. Dr. Torrey's allusion to "the society which we formed last winter," and to this catalogue as then in preparation, shows that the letter was written in the summer of 1817.

2. The first volume of Elliott's Sketch of the Botany of South Carolina and Georgia does indeed bear upon its title page the date of 1821, but we know that

it was issued in parts, at different dates, and as Dr. Torrey expressly says that he had received of the work as far as Pentandria Digynia, it is clear that he had only the first three parts. Dr. Gray (see his notes on the dates of issue of Elliott's sketch in *American Journal Science*, Series 3, Vol. 13, p. 81, 82,) has fixed the issue of Part III. as on or before April 3, 1817. This again would give the summer of 1817 as the period when the little circle of New York botanists were rejoicing over the possession of three parts of Elliott's work. At this time Dr. Torrey had just attained the age of twenty-one.

Such allusions as he had occasion in after years to make to Rafinesque's work, were even less complimentary than those of the letter.—J. H. R.

EDITORS GAZETTE:—Young botanists should all thank you for Dr. Torrey's letter, printed in the September GAZETTE. We all know his reputation as a cautious, careful, grand botanist, and he has been set off too long upon an unattainable pedestal. But now to find him a very enthusiastic and even rash young man is a revelation and a comfort. Young botanists who are so full of eagerness that they expect to do everything in short order and result in doing nothing well, should take courage, for enthusiasm may settle into love, and eagerness be turned into caution.*

Abnormal Anthemis Cotula.—A late flowering specimen of *Anthemis Cotula* presents an anomaly worth noting. The *disk-flowers* are entirely absent, and the head is composed of from 6–20 ligulate flowers arranged in the "double" fashion. These flowers are all *pistillate*, whereas the ray-flowers are usually neutral. The plant has about 30 heads, all showing the same peculiarity. None of its numerous neighbors were abnormal.—C. R. B.

Additional Note on Ustilagineæ.—In the August number of the GAZETTE reference was made to a *Doassansia* found growing on *Potamogeton* by Mr. Fletcher. At the time of writing, Cornu's paper, in which the genus was first described, had not been received in this country. Since then the number of the *Annales des Sciences* containing Cornu's description and plate, has come to hand. The genus is characterized by having globular masses of spores covered by a layer of dark ellipsoidal or prismatic cells. In germination the masses split open and the spores, thus set free, give out short tubes surmounted by a whorl of secondary cells resembling the germination in *Tilletia*. The species on *Potamogeton* has been recognized by De Bary as the *Sclerotium occultum* of H. Hoffman's Tab. Analyt. Fung. The type of the genus *Doassansia*, *D. alismatis* Cornu, was found on *Alisma Plantago* on an excursion to Lake Minnetonka during the meeting of the A. A. A. S. *Entyloma Menispermi* was also found in abundance near Hotel Lafayette. *Entyloma Lobeliæ* was found at Malden, Mass., by Mr. A. B. Seymour in July, and I have found it in several localities at Shelburne, N. H., so that the species is probably common in the East. In the proceedings of the Schlesische Gesellschaft for 1882, an *Entyloma Thalictri* is mentioned as a new species, found by Dr. Schroeter. I have not yet seen the description, but it is possible that it is to this species that the form on *Thalictrum*, found by Prof. Trelease, should be referred.—W. G. FARLOW.

Aquilegia longissima.—Apropos of Dr. Gray's note, it may be allowable to call attention to several of our American flowers with long, slender spurs, adapted to fertilization by the aid of *Aphingidæ*. Beside the long-spurred *Aquilegiæ*, which, despite the opinions of certain English writers on floral evolution, are more highly specialized than the European species of the genus, several flowers of this description occur in the West and Southwest. In the genus *Œnothera* there are not less than four such: *Œ. Missouriensis* (2–5′), *Œ. microsceles* (4–5′), *Œ. Jamesii* (3–5½′), and *Œ. cæspitosa* (2–7′). The flowers of *Macrosiphonia Berlandieri* are 3–5 inches long. *Mirabilis Wrightiana* reaches a length of 4½′; and *M. longiflora* 6½′; while over the line in Mexico, some of the species of *Nicotiana*, e. g. *N. longiflora*, reach a length of above three and a half inches.

These flowers require a longer proboscis than that of our common Eastern moths. Probably their most frequent visitor will be found to be *Amphonyx Antæus* Drury, one specimen of which, which was kindly examined for me by Mr. S. Henshaw, of the Boston Society of Natural History, had a tongue 5¾ inches long. It is quite probable that this length may be exceeded in other individuals.—Wm. Trelease.

The Grasses of the U. S.—Allow me to say in response to your kind note in the last number of the Gazette, respecting the recent pamphlet on the Grasses of the United States, that it is somewhat experimental, and designed to call out information and criticism as well as to give needed assistance, especially to Western botanists. A few omissions have been already pointed out, as for instance, *Panicum virgatum*, L., and *Glyceria Canadensis*, Trin., also some typographical errors. There is also an omission of one genus, viz. *Scleropogon*, of which we have at least one species in Texas and the South-west, viz: *S. Karwinskianus*, Benth., which has been frequently distributed under the name of *Tricuspis monstrosa*, Munro. Any information respecting omissions, errors, or notes as to local names, uses, etc., will be thankfully received.—Geo. Vasey.

Abnormal Clematis.—I have just had handed to me by Prof. E. W. Blake, Jr., a branch of *Clematis*, probably *C. patens*, showing a peculiar abnormality. It is terminated by the usual large flower. The first foliage leaf has the petiole twisted, as usual, for climbing. Above this the leaflet, for there is but one, is expanded into a blade, about half of which is petaloid, while the rest is green. The plant was grown in New Haven.—W. W. Bailey.

Erratum.—In my note on local names, in last issue, there occurs an *erratum*. For "mining berry" read "minnie-berry." But who ever reads a correction?—W. W. Bailey.

EDITORIAL NOTES.

Mr. Buckley has just named a Texan oak for Dr. Vasey, being a shrub or small tree of the group of black oaks.

We would earnestly urge all botanists who have grievances against the Postoffice Department in reference to packages of specimens to state them very briefly to Dr. Farlow, of Cambridge, Mass., Prof. Bessey, of Ames, Iowa, or

Prof. Coulter, of Crawfordsville, Ind., who are preparing to address the authorities at Washington upon the subject.

MR. A. P. MORGAN has published the third installment of his Mycologic Flora of the Miami Valley, Ohio. The great genus *Agaricus* having been disposed of, the present pamphlet begins with *Coprinus* and ends with *Lenzites*. Two colored plates illustrate Mr. Morgan's new species, *Coprinus squamosus* and *Hygrophorus Lauræ*. We also note as new *Russula incarnata*, *Marasmius fagineus* and *M. capillaris*. Of the 96 species described, Mr. Chas. Peck is responsible for 12.

THE AMERICAN JOURNAL OF SCIENCE seems to have had only its geologist at Minneapolis, and the report of the meeting, under the head of "Miscellaneous Scientific Intelligence," might as well have been included under "Geology." The statement that the "sections which had the largest number of papers were the geological and archæological," will not be sustained by the facts. The Geological section had 36 papers, Biology had 30, and Anthropology 25. The three papers of Prof. Cope, included in the report under the section of Geology, were referred to the section of Biology and read there.

THE TRANSLATION of Prof. Hermann Müller's "Die Befruchtung der Blumen durch Insekten," by Mr. D'Arcy Thompson, of Cambridge, England, is not only good service to the English speaking botanist who does not read German, but also to the many who do. The arrangement of the species in the translation is according to the system of Bentham & Hooker, instead of the German classification of the original. The preface is by Mr. Darwin, and is one of his last writings. The book is published by Macmillan & Co.

As we go to press we learn of the death of Dr. Müller, which occurred at Prad, in Tyrol, August 25. In him the world loses probably its chief authority in that department of natural history which deals with the mutual relations of insects and flowers. His works are vast storehouses of information, and will most probably always continue to be the principal source of information in their department. Dr. Gray says of him, in the October *Am. Jour. Sci.*, "By his most laborious and patient observations, by his great acuteness in interpretation and research, and by his studies of the modifications of insects in relation to flowers, no less than those of flowers to insects, he had placed himself at the head of this curious branch of biology, which was initiated by his countryman, Christian Conrad Sprengel, about one hundred years ago, resuscitated and more broadly based upon "the Knight-Darwin law," and the lead in which, since Darwin's death, is restored to Germany mainly by the researches of Hildebrand and Hermann Müller.

IN THE OCTOBER *Naturalist* Prof. Bessey gives the section divisions and principal synomymy of Lojacono's Revision of the N. Am. Trifolii, as published in the April number of *Nuovo Giornale Botanico Italiano*. We notice that Dr. Gray and Mr. Watson are each honored with a new California species, both cases being varieties raised to specific rank.

IN HIRAM SIBLEY'S *Grain and Farm Seeds Manual*, Dr. E. L. Sturtevant gives interesting histories of Indian corn, wheat, oats, barley, rye, buckwheat

and potatoes, and Prof. W. J. Beal has an illustrated paper on "Grasses," intended to give farmers some knowledge of the more common grasses they are likely to meet.

IT IS WITH a sense of personal loss that we record the death of Chas. F. Parker, curator of the Philadelphia Academy of Natural Sciences, which took place September 7. Mr. Parker was a bookbinder, being in charge of the binding department of *Godey's Lady's Book*, but as a botanist he was known in every herbarium of any pretension. His fine specimens of the famous New Jersey flora were always in demand, and no one had a more intimate knowledge of that region. His last days were spent in arranging the large herbarium of the Academy, and his friends write that the results were most satisfactory. Mr. Parker was one of the men that botanists hoped to meet next summer in Philadelphia, but his work remains as an humble but characteristic memorial of him.

J. E. TAYLOR, in *Science Gossip*, records the discovery of flies carrying away upon their feet the pollen masses from *Asclepias*, and it "struck him that it might be the method in which *Asclepias* is fertilized by insects," and he thereupon "suggests to North American botanists to examine" their various species of *Asclepias*, and see if insects are entangled, and have "pollen masses adhering to them." Where has Mr. Taylor been all these years? North American botanists were quick-sighted enough to discover this long ago, and even in some of our little Western colleges for several years the classes have been watching the insects at this work, and at the same time knew that they were examining what was common knowledge to every botanist in North America.

DR. JULIUS SACHS has just published a book entitled *Vorlesungen über Pflanzenphysiologie*, which is a series of lectures upon plant physiology, discussing the subject in a less formal way than his *Lehrbuch*. In reference to the latter, which has been so generally and constantly used in the German, French and English languages, it is interesting to hear the author expressing himself as follows: "As long as the artist is pleased with his work, he can add a touch here and there, or can even go in for greater changes; but this is not sufficient when the work has ceased to be the expression of his idea, and this is the attitude I stand in with regard to my text-book." This is given as a reason for not attempting another edition of the text-book, and makes English speaking botanists all the the more eager for a translation of the new work.

TWO THINGS STRUCK A NOVICE at Minneapolis rather unpleasantly in regard to the papers presented. The first was their careless preparation and still more careless presentation, half an hour being spent when five or ten minutes would have more than sufficed for a much clearer statement of all that was meant to be said. The second was the nature of the papers. Some were mere essays about well known facts, and most were observations about such trivial things that they could hardly be called profitable. While it may not be the object of the A. A. A. S. to cultivate a high degree of technicality, it should demand a certain amount of original work in the papers accepted.

TUCKAHOE, or Indian bread, is discussed at length by Prof. J. Howard Gore in the Smithsonian Report for 1881. Several things were eaten by the aborigines under this name, among them the underground portion of *Orontium aquaticum* and *Peltandra Virginica*, but it is now more generally applied to a fungus for which the name *Pachyma cocos* Fries is adopted.

LESTER F. WARD gives a systematic list and the distribution of 181 species of marsh and aquatic plants of the Northern United States, in signature 17 (vol. 3, p. 257) of the Bulletin of U. S. Fish Commission. Of this list 47 species printed in broad-face type are specially recommended by Dr. R. Hessel for carp ponds. It is noticeable that Dr. Hessel's list is wholly dicotyledonous, except *Naiadaceæ*, *Lemna*, *Pontederia*, and two rare plants, while both lists omit 8 out of the 11 kinds of plants named by Chas. W. Smiley, in answer to question 42—What plants are best for carp?—in signature 16, being such common plants as marsh marigold, water cress, white water-lilies, and Indian rice. Other less conspicuous omissions of flowering plants could be pointed out. No mention is made of *Chara* which in many western ponds and lakes is an important factor of the submerged vegetation. In some of the larger artificial lakes in the parks of Chicago it is so abundant as to require removal by dredging

DR. MOHN, of the Norwegian North Sea expedition, in his description (as given in *Nature*) of Jan Mayen Island, gives the following list of the plants collected: *Saxifraga cæspitosa*, L., *S. nivalis*, L., *S. oppositifolia*, L., *S. rivularis*, L., *Ranunculus glacialis*, L., *Halianthus peploides*, Fr., *Cerastium alpinum*, L., *Draba corymbosa*, R. Br., *Cochlearia officinalis*, L., *Oxyria digyna*, Campd., and *Catabrosa algida*, Fr.

DR. W. G. FARLOW summarizes the progress of botany during the year 1881 in an article of eighteen pages in the Smithsonian Report for that year lately issued. The first of these articles appeared in the preceding volume, embracing the years 1879 and 1880. They are excellent indices to the most important current literature in all departments of the science, and will be particularly valuable to ambitious workers who do not have access to a large scientific library.

THE LAST BULLETIN of the *Société Philomathique de Paris* contains an article by Roze on the male organs of *Azolla filiculoides*. The specimens were from the Botanic Garden of Bordeaux, and the first fruiting ones observed in France. The plants are monœcious, the conceptacles containing the male and female sporangia standing side by side. Each of the male or microsporangia contain six or seven cellular bodies or massulæ, in which the microspores are plunged, four in each. The massulæ contain a sufficient number of air cells, formed subsequently to the appearance of the microspores, to enable them to float on water The microspores do not escape, but, as in *Salvinia*, protrude the antheridia, the two terminal cells of which bear the antherozoids. These are quite similar to the antherozoids of *Salvinia*. It is now proven that all the vascular cryptogams have spiral antherozoids with two or more cilia anteriorly—several in *Azolla*—and a protoplasmic vesicle containing starch granules attached posteriorly. The archegonia have an interesting device mentioned by M. Roze.

The canal of the archegonium is terminated at its summit by a delicate hyaline membrane forming a sort of funnel, which is covered on the inner surface by excessively fine filaments, doubtless for the purpose of facilitating the passage of the antherozoids into the archegonium. It will be remembered that the same end is attained in *Marsilia* by means of a mass of mucilage at the mouth of the archegonium which acts as a funnel.

PUCCINIA PROSERPINACÆ *Farlow* has been found very plentiful about Chicago, in so far confirming the opinion given in the last GAZETTE (ante p. 302) that it is widely distributed.

VOLKENS, by examining plants early in the morning, taking precautions against deception by dew, has found a large number of plants exuding water. He describes, in the "Proceedings" of the Royal Botanic Gardens of Berlin, the water pores of 150 species of plants. His observations were mostly made upon wild plants.

IN SOME REMARKS before the American Association at Minneapolis, Dr. Farlow mentioned the discovery this season of peculiar conidiospores on some *Peronosporæ* from Illinois. Instead of the usual branched aërial hyphæ bearing numerous small spores being produced, there were extremely short ones having a few spores of large size. The discovery is so recent that no opportunity has been given to study their development, and their office can not be conjectured.

THE WATER-NET, *Hydrodictyon utriculatum*, is a very common alga throughout Minnesota, Iowa and Illinois. It is to be found in shallow water, along the banks of rivers and small streams, and in pools having a constant supply of water kept warm by the sun, noticeably those in stone quarries. It is quickly recognized by the large, angular meshes reaching half a centimeter or more in diameter, seen best by raising the plant from the water. The old vesicular mother-cells, a centimeter or two long, still containing the young nets, look much like dead and bleached worms, as they lie undisturbed in the water.

THE LIFE HISTORY of *Penicillium*, common blue mould, will soon be issued from the botanical laboratory of the Johns Hopkins University.

AUGUST VOGEL, in Westermann's *Monatshefte* (translated in *Pop. Sci. Mo.* for Oct.) sums up what is known in regard to the pigments of plants, but unfortunately includes among them some things that we don't know. Light has a powerful, but not indispensable, influence in determining vegetable colors, and their intensity depends somewhat on the intensity of the light. Almost none of the flower pigments are available as dyes on account of their transitory nature. If Herr Vogel's translator interprets him correctly, the explanation given of the white color of flowers—"generally produced by a white cellular juice"—is wide of the mark. In Herr Vogel's opinion, tannin is an important factor in the generation of vegetable colors. He also believes that the form of the pigment exerts great influence on the shade of color.

THE CONTINUITY OF THE PROTOPLASM throughout the plant seems to be settled with tolerable certainty. W. Hillhouse has just added to our knowledge on the subject a fresh series of observations, conducted in Prof. Strasburger's

laboratory at Bonn. The most successful method is as follows: Very thin radial and tangential sections of the cortical tissue of various trees or shrubs were treated on the slide, first with dilute and then with concentrated sulphuric acid. After carefully removing the acid with a pipette, the sections were washed thoroughly with distilled water and covered with glycerine. By this treatment the cell-wall (and often the middle lamella) is destroyed, and the protoplasmic thread between adjacent cells distinctly seen. The material for this work is best gathered in January. Sections may be cut from fresh specimens or from those which have lain some days in absolute alcohol. In the first case, however, the razor must be flowing with absolute alcohol.

THE RECENT EXPERIMENTS of R. Hartig to determine the tissue through which water moves in the plant, and the causes of the movement, lead him to the following conclusions: There are two types of trees, in one of which (e. g. oak) the duramen is incapable of conducting water, and the other (e. g. birch) in which the whole of the wood is conductive. Tracheides, and at times true vessels, are the chief organs for the transference of sap. The absorption of water by the roots is due to the osmotic forces in its cells, especially those of the root-hairs. The cause of the ascent of water in wood is the difference in density of the air in the conducting organs, and the pressure of the atmosphere exercises little or no influence on it.

ARTICLES IN JOURNALS.

"ANALYST, AN."—A Granule of Starch. *Pop. Sci. Mo.* 23. 687.

BAKER, J. G.—A synopsis of the genus Selaginella (5 new species, all from Central and S. Am.), *Jour. Bot.* 21. 240: Ferns collected by the Rev. Hanning in E. Tropical Africa (two new species, an Asplenium and a Notochlæna), l. c. 245: A study of the survival of the fittest, l. c. 271.

BOSWELL, H.—Two recent additions to the British Mosses (one being Sphagnum Torreyanum, Sulliv.), *Jour. Bot.* 21. 233.

BUCKLEY, S. B.—Some new Texan plants (4 species, all shrubs or small trees, one being a Quercus), *Torr. Bull.* 10 90.

CHRISTY, ROBERT MILLER and HENRY CORDER.—Arum maculatum and its cross-fertilization, *Jour. Bot.* 21. 225 and 262.

CORDER, HENRY.—See under "CHRISTY" above.

ELLIS, J. B. and B. M. EVERHART.—New species of Fungi (7 species), *Torr. Bull.* 10. 89.

EVERHART, B. M.—See under "ELLIS" above.

GREENE, EDWARD LEE.—New Western Compositæ (9 species) *Torr. Bull.* 10. 86.

GROVE, W. B.—A new Puccinia, *Jour. Bot.* 21. 274.

HANCE, H. F.—Orchidaceas quattuor novas Sinenses, *Jour. Bot.* 21. 231: Heptadem Filicum Novarum Sinicarum (7 species), l. c. 257: Disporopsis, genus novum Liliacearum (from China), l. c. 278.

HEMSLEY, W. BOTTING.—Bermuda plants in the Sloane collection, British Museum, (with plate and description of a new Carex) *Jour. Bot.* 21. 257.

HILL, E. J.—Potamogetons in W. New York, *Torr. Bull.* 10. 92: Means of plant dispersion (continued from August number), *Am. Nat.* 17. 1028.

KIDD, H. W.—Notes on fasciated stems (with cut), *Sci. Gossip*, No. 225. 196.

PIM, GREENWOOD.—On Alliospora, a supposed new genus of Dematiei, *Jour. Bot.* 21. 334.

ROZE, E.—Male organ of Azolla filiculoides Lam., *Bull. Soc. Philom. de Paris*, Ser. 7. 7. 133.

SCRIBNER, F. LAMSON.—Notes on Spartina (with plate), *Torr. Bull.* 10. 85.

SEDGWICK, W. T.—Symbiosis and Vegetating Animals (Review of controversy between Brandt, Geddes, Lankester et al.), *Pop. Sci. Mo.* 23 811.

TRELEASE, W.—Notice of Farlow's notes on Ellis' N. Am. Fungi, *Science*, 2. 410.

VOGEL, AUGUST.—The colors of flowers (considered chemically), *Pop. Sci. Mo.* 23. 837.

WARD, LESTER F.—Marsh and aquatic plants of the Northern U. S., many of which are suitable for carp ponds, *Bull. U. S. Fish Com.* 3. 257.